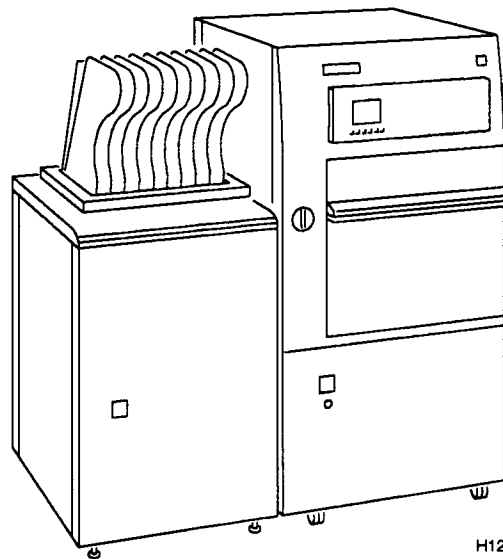




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3/1995

Self-Study Training Workbook
for the
KODAK X-OMAT 180 LP
SORTER
accessory to the 180 LP/LPS PROCESSOR



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A CESD TRAINING PROGRAM
PROGRAM 1C7848

PLEASE NOTE

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Module 1

Getting Started

Document Purpose and Intended Audience



The purpose of this training is to:

- Have you become familiar with the Sorter and its Service Documentation
- Have you become familiar with Error Codes and Diagnostic procedures
- Review the skills and procedures required for servicing the Sorter

The SORTER is an accessory to the *KODAK X-OMAT* 180 LP PROCESSOR. The 180 LP Processor is attached to the *KODAK EKTASCAN* 2180 LASER PRINTER.

This document is intended to be used by students who have completed or are currently taking RA Processor Training. It is a Self-Study Workbook but may be used in conjunction with the RA Training program. Knowledge of the 180 LP Processor is a prerequisite of this workbook. Access to a 180 LP Processor and Sorter is desirable but not required to complete this training.

How to Use this Self-Study Workbook

Follow these guidelines for completing this training program:

- Make sure you have all the documentation required for this training (see "References and Resources" on page 7).
- Follow the directions in this Workbook.
- Progress sequentially from the beginning to the end of this Workbook.
- Refer to the service documentation when directed to do so.
- Complete each Training Module and its practice exercises before progressing to the next Module.
- Use the Answer Key in the back of the Workbook to check your answers in the Practice Exercises.
- Review any areas you have problems with before proceeding to the next Module. Use all available resources to assist your learning process:
 - This Self-Study Training Workbook
 - Sorter Service Manual
 - Software Diagnostics and its instructions
 - Sorter and 180 LP Processor (if available)
 - Co-worker or supervisor
- **You are responsible for your own learning progress.**

Course Description

This Self-Study Workbook is divided into 7 Modules. These Modules are:

- **Module 1:** Getting Started
- **Module 2:** Documentation Overview
- **Module 3:** Sorter Overview
- **Module 4:** Theory of Operation
- **Module 5:** Sorter Components
- **Module 6:** Troubleshooting and Diagnostics
- **Module 7:** Answer Key to Practice Exercises

Follow the directions and answer all the questions in the Review Exercises. Refer to the Service documentation as instructed and as needed. If this Workbook is being used in conjunction with classroom training, refer to the equipment on hand to enhance the learning process. The back of this Workbook contains the Answer Key to the Review Questions.

Total projected time for completing this Self Teach Workbook is approximately 1-2 hours. (Times may vary, depending upon your skill level, learning style and availability of equipment.)

Course Objectives

Upon completing this training, you will be able to:

- Identify the correct sections of the service publication for information on given topics and procedures
- Describe the Theory of Operation
- Identify the locations and describe the functions for these SORTER components:
 - Switches
 - Sensors
 - Interlocks
 - Circuit Boards
 - Solenoids
 - Roller Transport mechanisms
 - Drive Motors
- Identify the locations and describe the functions of these 180 LP PROCESSOR components:
 - 500 Circuit Board
 - Encoder Wheel/Sprocket
 - Processor Drive Motor
- Identify and describe the various Error Codes for the Sorter

- Identify basic troubleshooting and repair procedures for the Sorter
- Identify the functions and value of the Diagnostic Software

References and Resources

The following are required materials for completing this training:

- **KODAK X-OMAT 180 LP Sorter Service Manual** (Publication No. 1C7833)

This publication includes the following Sections:

- Section 1: Installation of the Sorter
 - Section 2: Adjustments and Replacements
 - Section 3: Theory of Operation
 - Section 4: Diagnostics
 - Section 5: Component Locator
 - Section 6: Diagrams
 - Section 7: Illustrated Parts List
- **User Instructions for the Software Diagnostics for the KODAK X-OMAT RA and LP/LPS Processors** (Publication No. 699614)

If these Publications are not available, order them from "Advertising Distribution" at Eastman Kodak Company by calling 1(800)233-1650.

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Module 2

Documentation Overview

Objectives



After completing this module, you will be able to:

- Identify the correct Section of the Sorter Service Manual for given topics and procedures
- Look up specific information that is in the Sorter Service Manual

Service Manual Contents



Obtain your Sorter Service Manual (Pub. No. 1C7833) and review it for the following contents:

Section 1: Installation

- Identifies Special Tools required for installing the Sorter
- Gives step-by-step procedures for installing a Sorter onto a 180 LP Processor
- Gives procedures to check the operation of various Sorter components

Section 2: Adjustments and Replacements

- Identifies Special Tools required for servicing the Sorter
- Identifies Electrostatic Discharge (ESD) procedures
- Provides instructions on how to access the Sorter or Processor
- Gives step-by-step instructions for removal of components and subassemblies
- Provides adjustment procedures

Section 3: Theory of Operation

- Provides a product function description
- Describes a basic sequence of operation
- Gives a detailed description of voltage and control logic at individual circuit board level
- Gives a description of Error Codes

Section 4: Diagnostics

- Provides an organized structure to troubleshooting using Error Codes
- Gives step-by-step procedures to test various components

Section 5: Component Locator

- Shows the locations for Connectors, Circuit Boards, Integrated Circuits, LEDs, Motors, Relays, Solenoids, Sensors and Switches
- Provides Plug, Jack, electrical connectors and Test Point locations

Section 6: Diagrams

- Provides AC and DC diagrams for the Sorter and the 180 LP/LPS Processor.

Section 7: Illustrated Parts List

- List all spare parts available for the Sorter from Service Parts Management at Kodak
- Locates each part on an exploded parts illustration
- Provides the part name and number in table format
- Provides a Numeric Index for Sorter parts

Review Questions - Module 2**PRACTICE
EXERCISE**

Answer the following questions. Refer to the Sorter Service Manual as needed.

Multiple Choice

1. An equipment operator tells you an Error Code for the Sorter and wants to know what it indicates. You will find a description of Error Codes in this section of the Service Manual:
 - a. Illustrated Parts List
 - b. Diagrams
 - c. Adjustments and Replacements
 - d. Theory of Operation
2. Which section provides information on the use of technology in the Sorter?
 - a. Installation
 - b. Diagnostics
 - c. Component Locator
 - d. Theory of Operation
3. You have an Error Code and want to identify its potential causes. Look in this section:
 - a. Diagnostics
 - b. Theory of Operation
 - c. Adjustments and Replacements
 - d. Component Locator
4. You have a part that needs to be ordered as a replacement. You will find the Part Number in this section:
 - a. Component Locator
 - b. Installation
 - c. Illustrated Parts List
 - d. Adjustments and Replacements

5. As few as _____ volts from static can damage or destroy essential electrical components.
- a. 30
 - b. 500
 - c. 1,000
 - d. 30,000

Answers to Module 2 Practice Exercise begin on page 31

Module 3

Sorter Overview

Objectives



After completing this module, you will be able to:

- Describe the features and functions of the Sorter
- Describe the film path through the Sorter

Product Description



The 180 LP SORTER is an optional accessory to the *KODAK X-OMAT* 180 LP PROCESSOR. The Sorter is installed (either in manufacturing or in the field) on top of the 180 LP Processor and is intended to provide increased convenience to the operator. The Sorter's purpose is to transport processed film into one of its nine BINS. Each Bin can be assigned by the operator one or more modalities. These assigned modalities assist the operator in quickly finding and retrieving their processed films.

Read in the Sorter Service Manual, *Overview* in Section 3, "Theory of Operation"

Read in the Sorter Service Manual, *Service Overview* in Section 2, "Adjustments and Replacements." This review is to include:

- Position and identification of Subassemblies
- De-energizing and Energizing the Processor
- General Access to the Sorter or to the Processor

When you have completed the reading, answer the Review Questions on the next page.

Review Questions - Module 3**PRACTICE
EXERCISE**

Answer the following questions. Refer to *Overview* in Section 4, "Theory of Operation" of the Sorter Service Manual as needed.

Multiple Choice

1. The Sorter:
 - a. is an accessory to the 480 RA Processor.
 - b. is inside the Top Cover of the 180 LP Film Processor.
 - c. is on top of the 2180 Laser Printer.
 - d. is a stand alone unit.
2. Each Bin can hold ____ sheets of film.
 - a. 100
 - b. 25
 - c. 50
 - d. 75
3. Processed films are assigned to the BINS by:
 - a. "Default;" with Bin #1 receiving film until full, then Bin #2, then Bin #3...up to Bin #9.
 - b. Sensors on the Sorter indicate which Bin is empty and able to receive film.
 - c. the operator of the 2180 Laser Printer at the Display Panel.
 - d. the Processor's 4000 Circuit Board.
4. Which statement describes how Bin modality can be assigned:
 - a. One modality assignment per Bin.
 - b. Multiple modality assignments can go to one Bin.
 - c. One modality assignment can go to multiple Bins.
 - d. All of the above

5. To bypass a malfunctioning Sorter so that you can still process film, you would:
 - a. Remove the Bin Assembly from the top of the Processor.
 - b. Operate the Sorter by setting the program so that all films exit at Bin #9 only.
 - c. Remove the Bin Assembly and lift the Sorter so that processed films are received in the Film Tray.
 - d. Have the films exit the Processor at the side film gate.
6. Which Sorter Module number has spring loaded rollers that press against a Bin Roller that is used to transport smaller size sheet films through the Sorter?
 - a. Module #1
 - b. Module #5
 - c. Module #6
 - d. Module #9
7. The Sorter Drive Motor:
 - a. operates independently and at one speed.
 - b. is controlled by the 2180 Laser Printer and can operate at "Standard," "Rapid" and "Extended" speeds.
 - c. operates at a variable speed, controlled by the 100 Circuit Board.
 - d. operates in synchronous speed with the Processor Drive Motor.
8. Infrared (IR) film detector Sensor(s) for the Sorter are located:
 - a. at the Processor's Entrance Slot.
 - b. at the Exit Gate of the 2180 Laser Printer.
 - c. at the Exit Rack of the Film Processor.
 - d. in the Sorter Modules.

9. The Sorter is positioned above the Processor. For safety reasons and for ease of service, use the following precaution(s) during servicing:
 - a. Remove the Sorter from the Processor.
 - b. De-energize the Processor at the CB1 Main Circuit Breaker.
 - c. Lay a cloth over the Processor to prevent small parts from dropping into the tanks and racks.
 - d. Both a and b.
 - e. Both b and c.

Answers to Module 3 Practice Exercise begin on page 33.

Module 4

Theory of Operation

Objectives



After completing this module, you will be able to:

- Describe the theory of operation at the various component levels
- Identify the functions of different Sorter components
- Use diagrams to trace a signal path

Component Level Theory of Operation

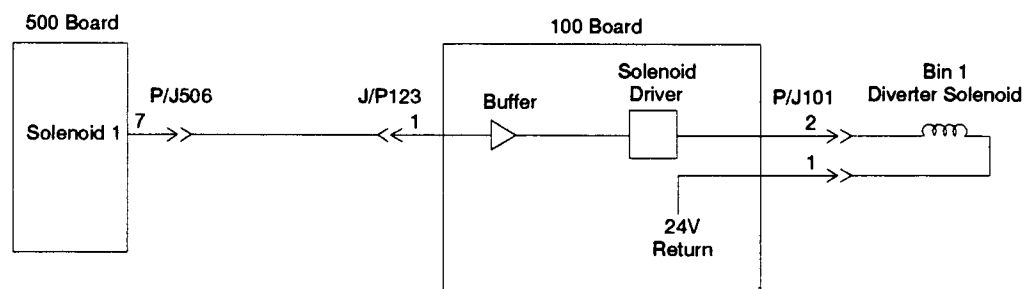


Review in the Sorter Service Manual, *Operation of Boards* in Section 3, "Theory of Operation".

Diverter Solenoids

The Diverter Solenoid activates a Diverter. The activated Diverter redirects film into a Bin as the film is transported through the Sorter. Diverters and Solenoids are used for Bins 1-8. Bin 9 uses a fixed metal deflector instead of a Solenoid and Diverter.

Refer to Section 3, "Theory of Operation" in the Sorter Service Manual for a detailed explanation of these components.

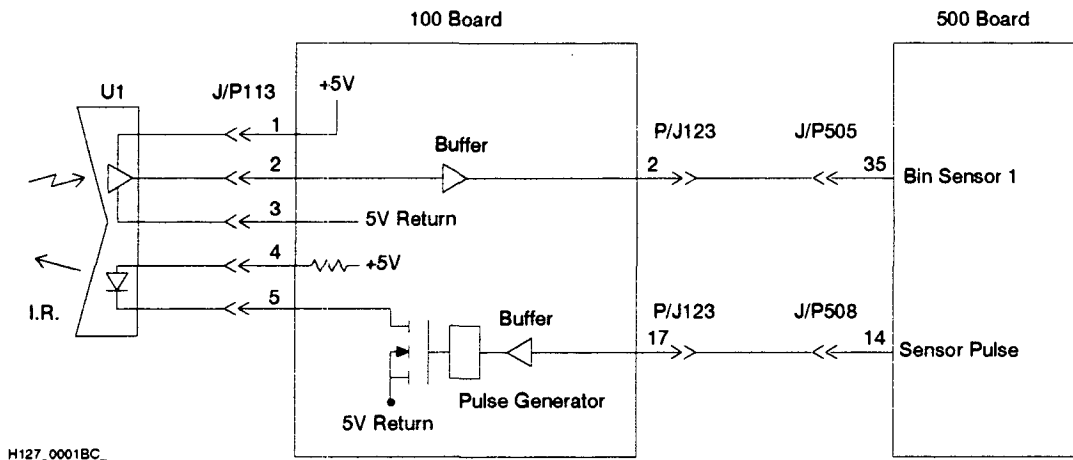


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Bin Sensors

The Bin Sensor detects when film is present and being directed into a Bin. There is a Bin Sensor at each of the 9 Bins.

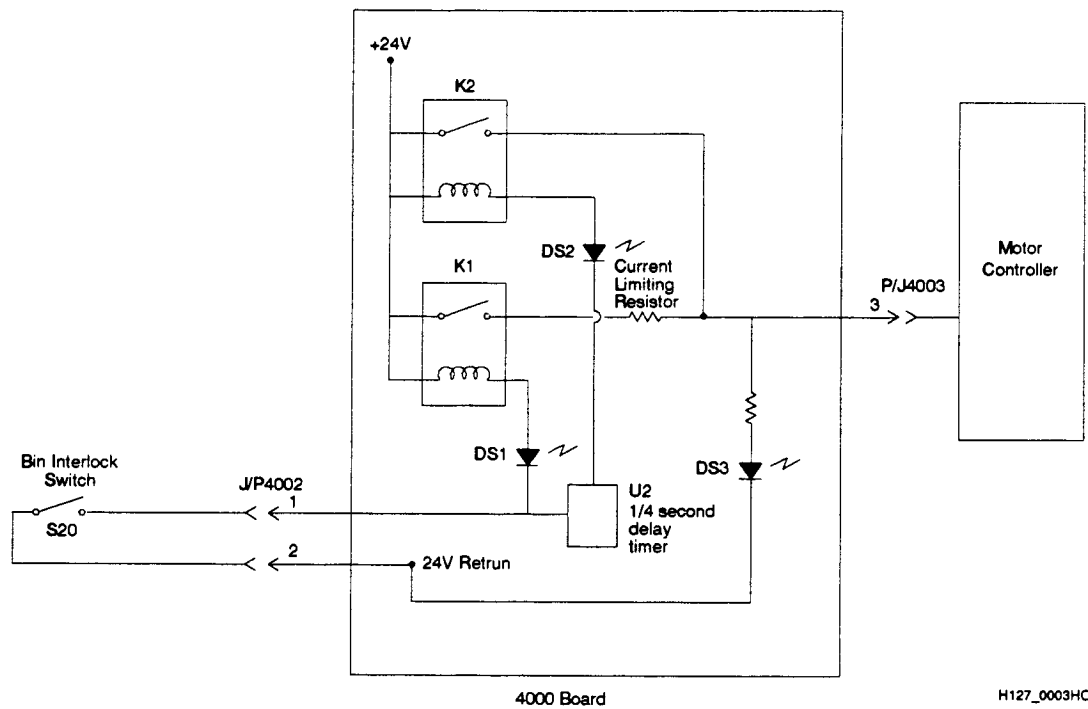
Refer to Section 3, "Theory of Operation" in the Sorter Service Manual for a detailed explanation of these components.



Interlock Board

The Interlock Board (4000 Circuit Board) disables the Sorter transport mechanism when the Bin Assembly is removed from the Sorter.

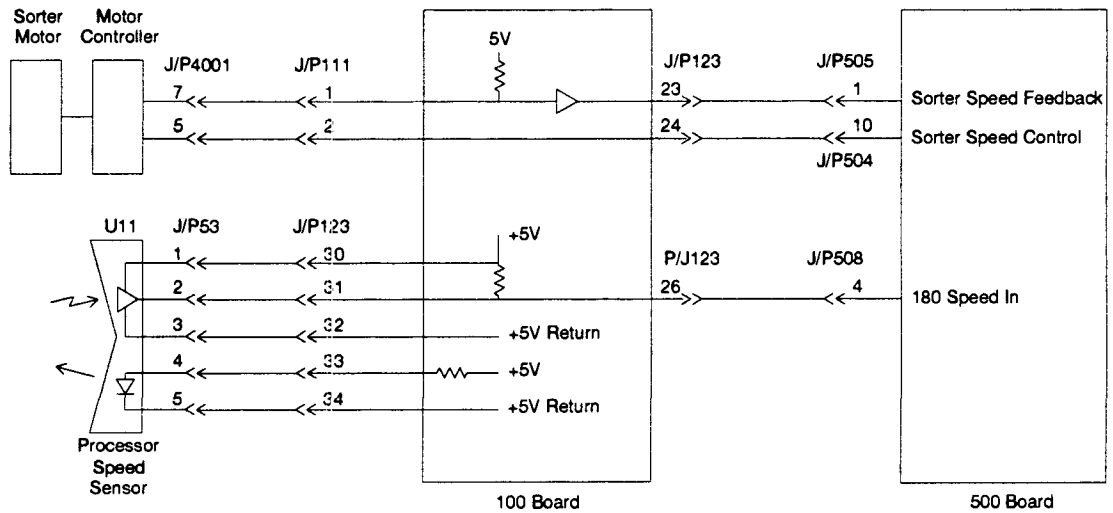
Refer to Section 3, "Theory of Operation" in the Sorter Service Manual for a detailed explanation of these components.



Sorter Transport

The Sorter Drive Motor is designed to run in synchronous speed with the Processor Drive Motor. This diagram shows the current for the speed control of the Sorter Drive Motor.

Refer to Section 3, "Theory of Operation" in the Sorter Service Manual for a detailed explanation of these components.



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Review Questions - Module 4**PRACTICE
EXERCISE**

Answer the following questions. Refer to the "Theory of Operation" Section in the Sorter Service Manual as needed.

Fill-in the Blanks

1. Software on the _____ Board monitors the motor speed of the Processor and the Sorter. It also adjusts the voltage to the _____ Drive Motor Controller so that the Sorter and the Processor operate at the same speed.
2. The Sorter Drive Motor sends a pulsed 5 volt signal indicating its speed to the _____ Board and then to the _____ Board where the software monitors the Sorter Drive Motor speed.
3. The 100 Circuit Board powers an _____ at the Processor's Encoder Wheel/Sprocket.
4. The Diverter Solenoid is initially energized with _____ volts and within $\frac{1}{4}$ second the voltage decreases to _____ volts to hold the Diverter open until the film is in the Bin.
5. The signal to energize the Diverter Solenoid originates at this board:

6. The _____ supplies a 24 volt return to the K1 Relay on the Interlock (4000) Circuit Board when the _____ is on the Sorter.
7. On the Interlock Board, the _____ Relay applies a 24 volt signal through a circuit-limiting resistor to the Motor Control Board $\frac{1}{4}$ second before the _____ Relay applies a 24 volt signal directly to the Motor Controller Board.
8. For the Interlock circuit, LED _____ is energized to indicate 24 volts is going to the Motor Controller Board.
9. The _____ Board is a safety device that can disable the Sorter transport mechanisms.

Answers to Module 4 Practice Exercise are on page 36.

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Module 5

Sorter Components

Objectives



After completing this module, you will be able to:

- Identify and locate the main components of the Sorter
- Identify in the Sorter Service Manual where component information is located.

Component Identification

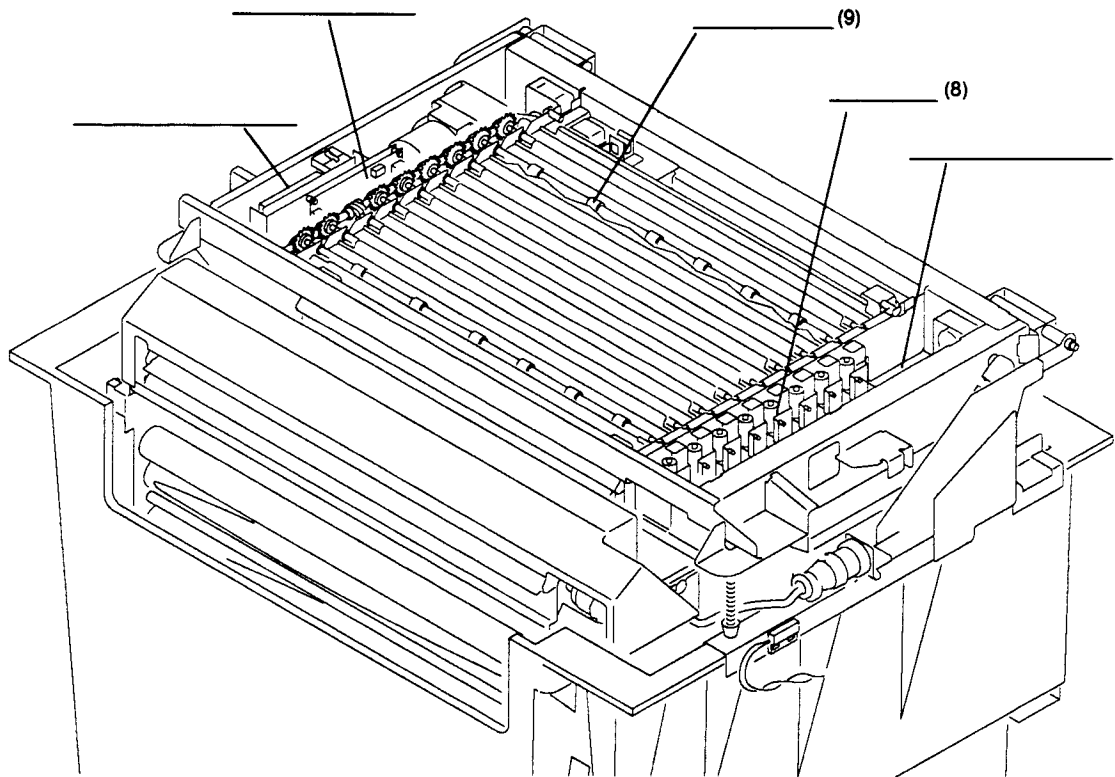


Refer to Section 3, "Theory of Operation;" Section 5, "Component Locator;" and Section 6, "Illustrated Parts List" in the Sorter Service Manual for completing this Module. Review the illustrations to become familiar with the Sorter Components. Identify the part locations for the list of parts on the following page of this training manual.

Review Questions - Module 5**PRACTICE
EXERCISE**

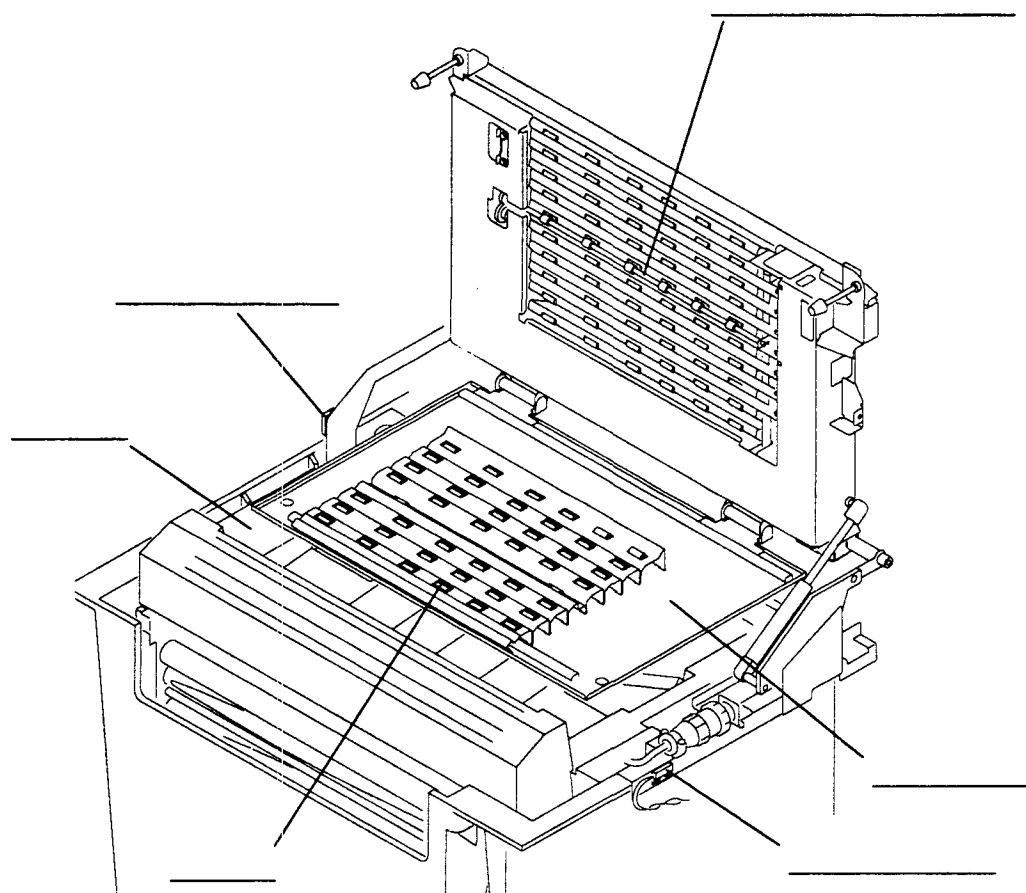
Fill-in the blanks on the following illustrations with the correct component name from the list below. Place a check mark (✓) on the components listed below as you identify them in the following illustrations. A double box (□□) indicates that the component is to be identified in two different illustrations. The number in parenthesis (i.e. "(9)") indicates how many of that component exist in the Sorter. (You will identify only one or two of these components.) Refer to your service documentation as needed.

- ☐ Bin Assembly
- ☐ Access Door
- ☐ Film Tray
- ☐ Interlock Switch (for the Bin Assembly)
- ☐ Switch (for the Top Cover)
- ☐ Switch (for the Film Tray)
- ☐ Sorter Drive Motor
- ☐ Sorter Main Drive Shaft/Worm Gear
- ☐ Lower Transport Roller
- ☐ Bin Rollers (9)
- ☐ Lead Module
- ☐ Main Modules (8)
- ☐ Transport Module
- ☐ Bin Sensor (9)
- ☐ Diverter Solenoids (8)
- ☐ Diverters (8)
- ☐ Encoder Wheel/Sprocket
- ☐ Interlock Circuit Board (4000)
- ☐ 500 Circuit Board
- ☐ Motor Controller Circuit Board
- ☐ 100 Circuit Board
- ☐ Processor Main Drive Shaft
- ☐ Processor Drive Motor
- ☐ 180 Speed Sensor
- ☐ Rollers



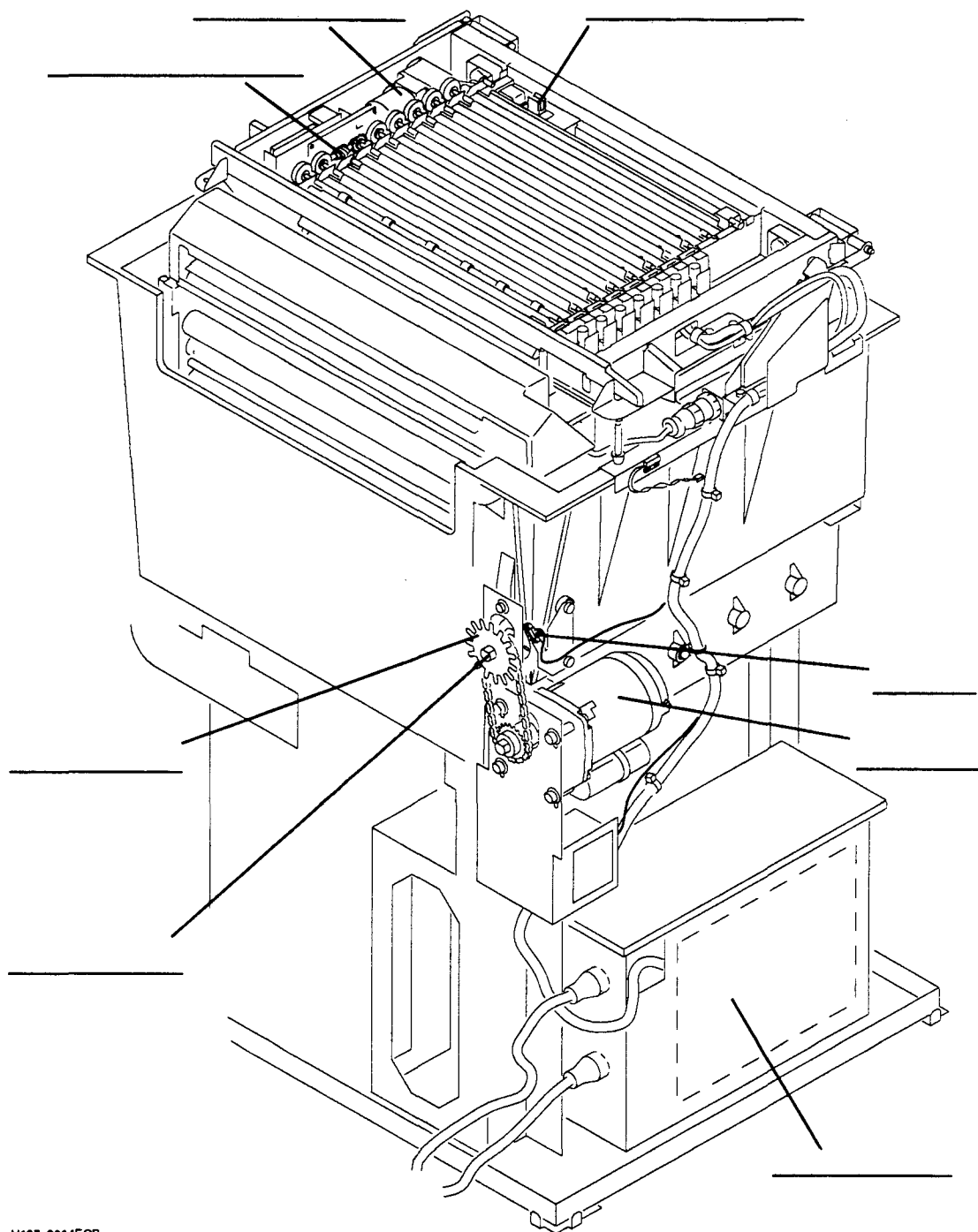
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Sorter, Top View Closed



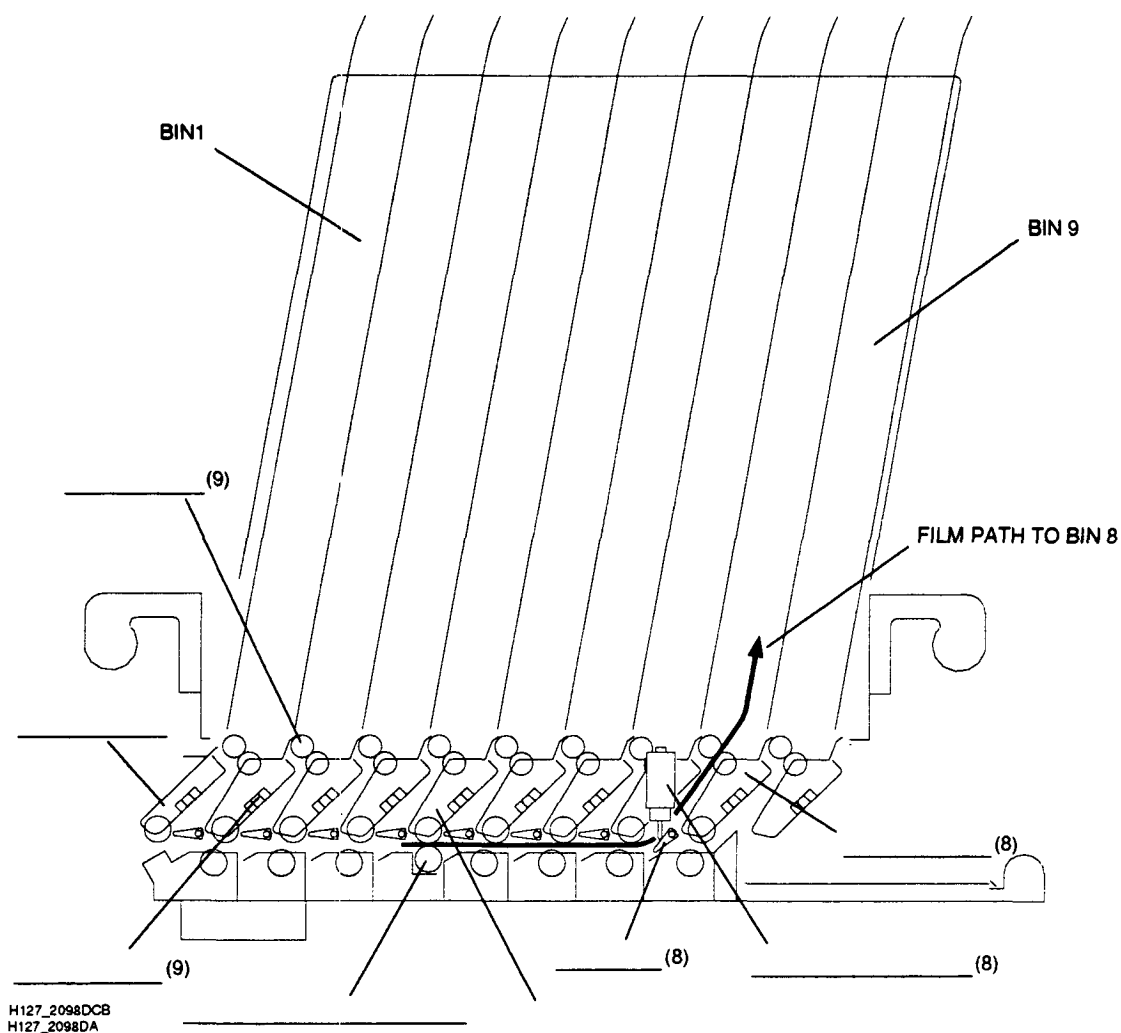
H127_2087DCC
H127_2087DA

Sorter, Top View Open



H127_2084ECB
H127_2084EA

Sorter and Processor, Full View



Sorter, Cross Section View

Answers to Module 5 Practice Exercise begin on page 37.

Module 6

Troubleshooting and Diagnostics

Objectives



After completing this module, you will be able to:

- Identify where information on Error Codes can be found in the Service Manuals.
- Define Error Codes and explain the problems represented by them.
- Identify what Diagnostic functions can be done using the Diagnostic Software.

Error Codes and Diagnostics



The equipment operator can see Error Codes for the Sorter on the Display Panel of the 2180 Laser Printer. The Processor's 500 Circuit Board also stores in memory Error Codes for the Sorter. These Error Codes can be retrieved with the use of a laptop computer and the *KODAK X-OMAT* RA and LP/LPS PROCESSOR DIAGNOSTIC SOFTWARE (Version 2.55) (Part No. 5B6278).

Review the Error Code information in the following Sections of the Sorter Service Manual.

- "Theory of Operation - Explanation of Error Codes"
- "Diagnostics - Error Codes"

Review "User Instructions for the Software Diagnostics for the *KODAK X-OMAT* RA and LP/LPS Processors" (Publication No. 699614). This is the software diagnostic user manual.

Review Questions - Module 6**PRACTICE
EXERCISE**

Answer the following questions. Refer to your service documentation as needed.

Fill-in the Blanks

1. The Error Code is stored in the memory of the Processor's 500 Board. Use your _____ to retrieve the Error Code.
2. Troubleshooting information in table format for Error Codes can be found in this Section of the Service Manual: _____
3. The machine is indicating an Error Code "E097." What does this mean?

4. Error Code "E093" indicates that film did not arrive in Bin #3. An inspection finds no film jam and that the Diverters for Bins #1 and #2 operate normally. What two other possible malfunctions could cause this error?

5. With the Bin Assembly in position, you receive an Error Code "E080." A check of the 4000 Circuit Board shows that all three LED's are deenergized. What is the most likely malfunction? _____

6. The speed of the processor is out of range (Error Code E082) and the Processor transport is running. What test point would you check for a pulse signal that indicates the U11 Sensor needs to be replaced? _____
7. A quick procedure that can be used to check the operational status of a Bin Sensor is to: _____

8. Your Software Diagnostics indicates a Solenoid is not functioning. A quick procedure to check if it is the Solenoid that is faulty is to:

Answers to Module 6 Practice Exercise are on page 41.

Module 7

Answer Key to Practice Exercises

Module 2

Documentation Overview



Use this Answer Key to check your answers to the Practice Exercises for each Module. Review the Service Manuals for any sections that you had difficulty with.

Multiple Choice

1. An equipment operator tells you an Error Code for the Sorter and wants to know what it indicates. You will find a description of the Error Code in this section of the Service Manual:
 - a. Illustrated Parts List
 - b. Diagrams
 - c. Adjustments and Replacements
 - d. Theory of Operation
2. Which section provides information on the use of technology in the Sorter?
 - a. Installation
 - b. Diagnostics
 - c. Component Locator
 - d. Theory of Operation
3. You have an Error Code and want to identify its potential causes. Look in this section:
 - a. Diagnostics
 - b. Theory of Operation
 - c. Adjustments and Replacements
 - d. Component Locator

4. You have a part that needs to be ordered as a replacement. You will find the Part Number in this section:
 - a. Component Locator
 - b. Installation
 - c. Illustrated Parts List
 - d. Adjustments and Replacements
5. As few as _____ volts from static can damage or destroy essential electrical components.
 - a. 30
 - b. 500
 - c. 1,000
 - d. 30,000

Module 3
Sorter Overview**Multiple Choice Review**

1. The Sorter:
 - a. is an accessory to the 480 RA Processor.
 - b. is inside the Top Cover of the 180 LP Film Processor.
 - c. is on top of the 2180 Laser Printer.
 - d. is a stand alone unit.
2. Each Bin can hold ____ sheets of film.
 - a. 100
 - b. 25
 - c. 50
 - d. 75
3. Processed films are assigned to the BINS by:
 - a. "Default;" with Bin #1 receiving film until full, then Bin #2, then Bin #3...up to Bin #9.
 - b. Sensors on the Sorter indicate which Bin is empty and able to receive film.
 - c. the operator of the 2180 Laser Printer at the Display Panel.
 - d. the Processor's 4000 Circuit Board.
4. Which statement describes how Bin modality can be assigned:
 - a. One modality assignment per Bin.
 - b. Multiple modality assignments can go to one Bin.
 - c. One modality assignment can go to multiple Bins.
 - d. All of the above

5. To bypass a malfunctioning Sorter so that you can still process film, you would:
 - a. Remove the Bin Assembly from the top of the Processor.
 - b. Operate the Sorter by setting the program so that all films exit at Bin #9 only.
 - c. Remove the Bin Assembly and lift the Sorter so that processed films are received in the Film Tray.
 - d. Have the films exit the Processor at the side film gate.
6. Which Sorter Module number has spring loaded rollers that press against a Bin Roller that is used to transport smaller size sheet films through the Sorter?
 - a. Module #1
 - b. Module #5
 - c. Module #6
 - d. Module #9
7. The Sorter Drive Motor:
 - a. operates independently and at one speed.
 - b. is controlled by the 2180 Laser Printer and can operate at "Standard," "Rapid" and "Extended" speeds.
 - c. operates at a variable speed, controlled by the 100 Circuit Board.
 - d. operates in synchronous speed with the Processor Drive Motor.
8. Infrared (IR) film detector Sensor(s) are located:
 - a. at the Processor's Entrance Slot.
 - b. at the Exit Gate of the 2180 Laser Printer.
 - c. at the Exit Gate of the Film Processor.
 - d. in the Sorter Modules.

9. The Sorter is positioned above the Processor. For safety reasons and for ease of service, use the following precaution(s) during servicing:
- a. Remove the Sorter from the Processor.
 - b. De-energize the Processor at the CB1 Main Circuit Breaker.
 - c. Lay a cloth over the Processor to prevent small parts from dropping into the tanks and racks.
 - d. Both a and b.
 - e. Both b and c.

Module 4

Theory of Operation



Fill-in the Blanks

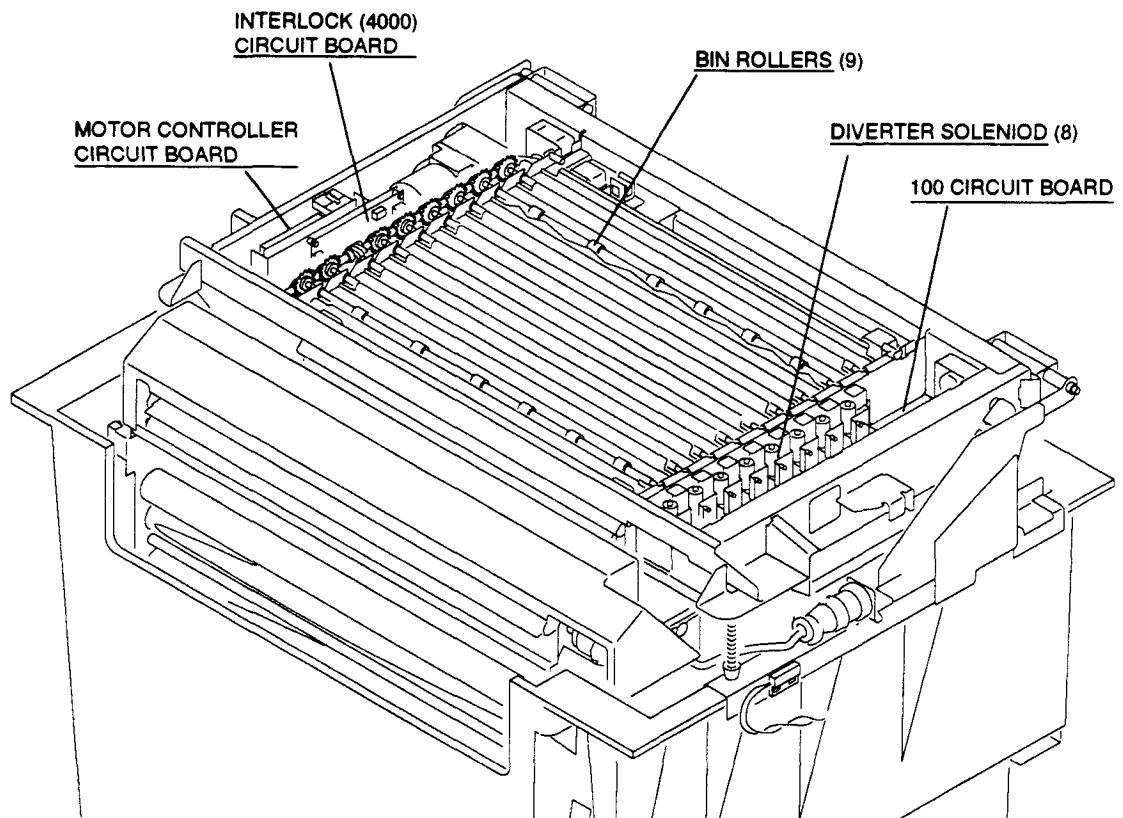
1. Software on the 500 Board monitors the motor speed of the Processor and the Sorter. It also adjusts the voltage to the Sorter Drive Motor so that the Sorter and the Processor operate at the same speed.
2. The Sorter Drive Motor sends a pulsed 5 volt signal indicating its speed to the 100 Board and then to the 500 Board where the software monitors the Sorter Drive Motor speed.
3. The 100 Circuit Board powers an Infrared (IR) LED at the Processor's Encoder Wheel/Sprocket.
4. The Diverter Solenoid is initially energized with 18-24 volts and within $\frac{1}{4}$ second the voltage decreases to 4-6 volts to hold the Diverter open until the film is in the Bin.
5. The signal to energize the Diverter Solenoid originates at this board: 500.
6. The Interlock Switch (S1) supplies a 24 volt return to the K1 Relay on the Interlock (4000) Circuit Board when the Bin Assembly is on the Sorter.
7. On the Interlock Board, the K1 Relay applies a 24 volt signal through a circuit-limiting resistor to the Motor Control Board $\frac{1}{4}$ second before the K2 Relay applies a 24 volt signal directly to the Motor Controller Board.
8. For the Interlock circuit, LED DS3 is energized to indicate 24 volts is going to the Motor Controller Board.
9. The 4000 Interlock Board is a safety device that can disable the Sorter transport mechanisms.

Module 5

Sorter Components

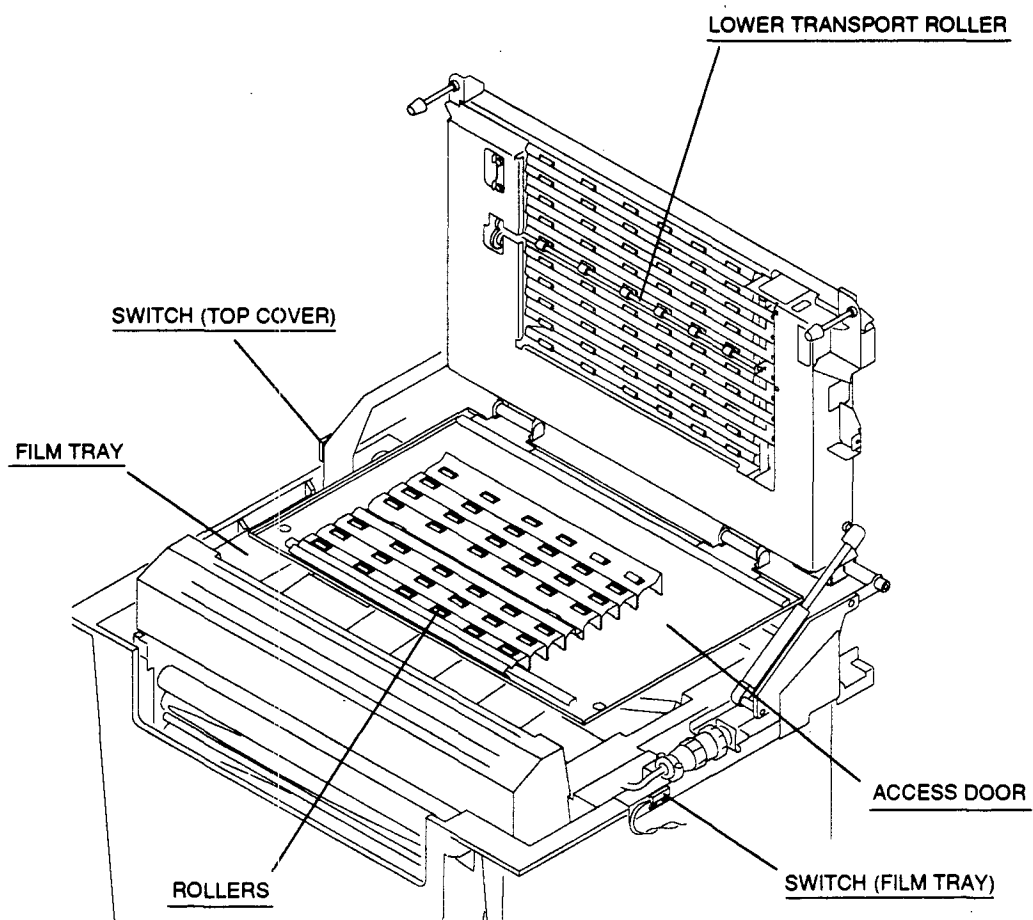


Sorter components identified.



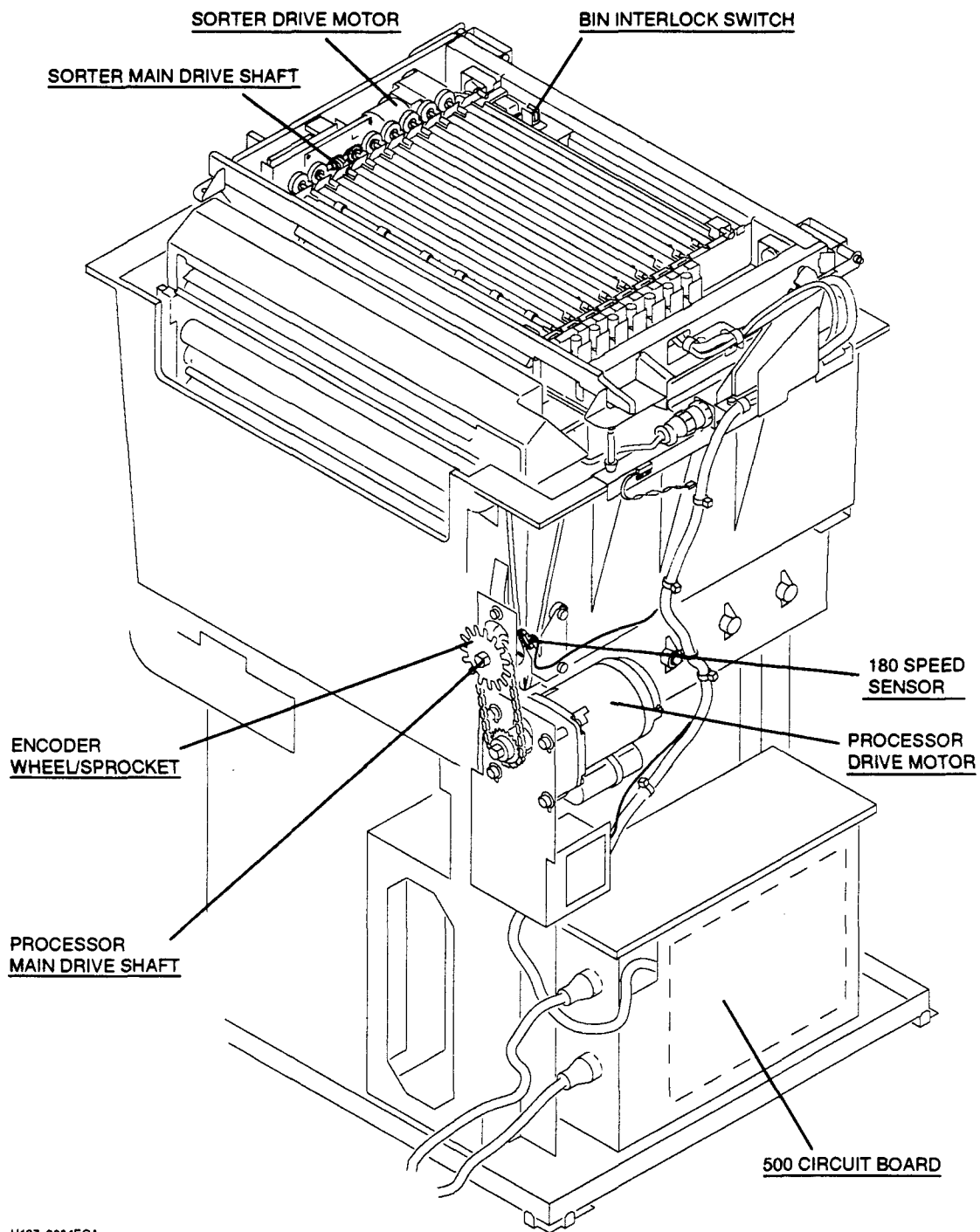
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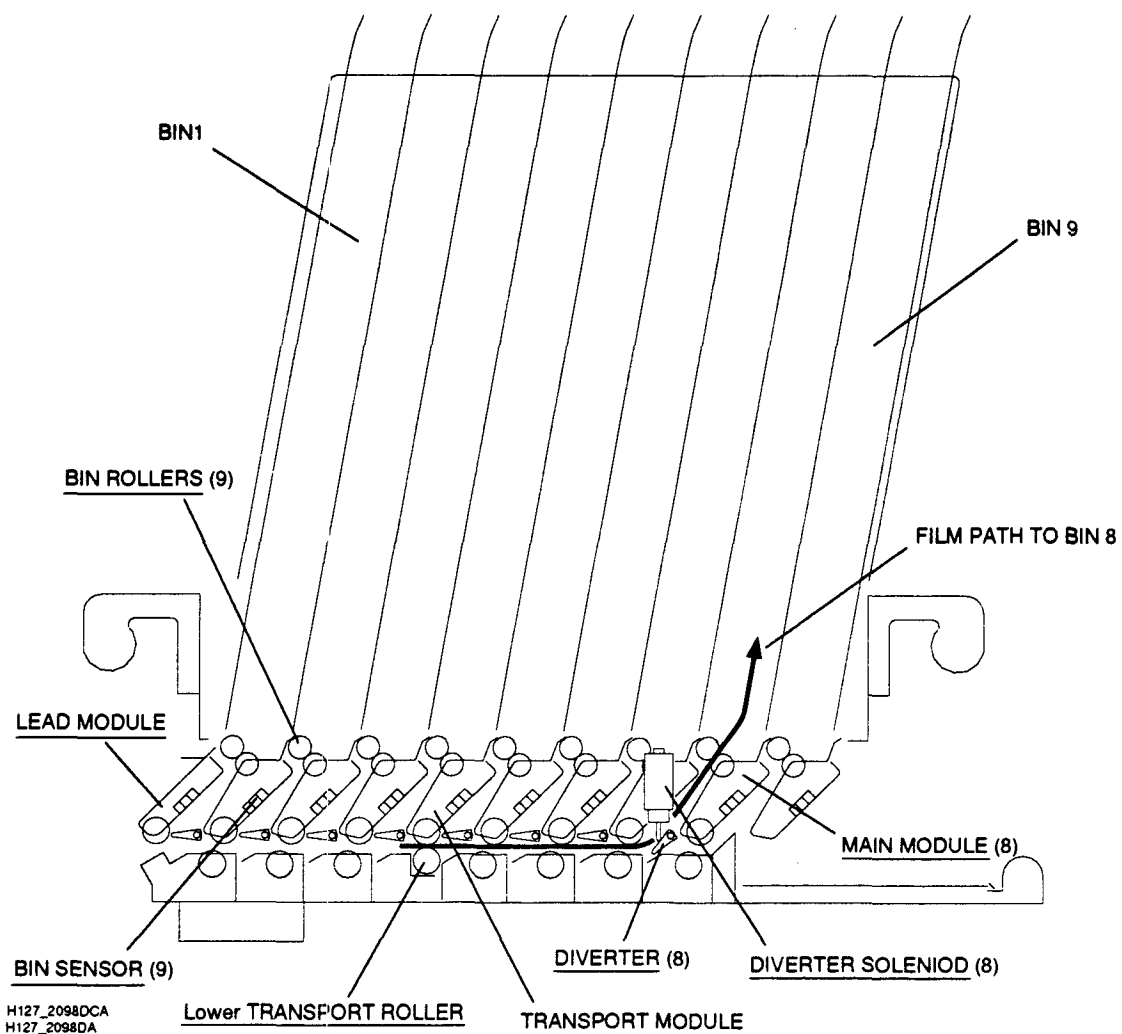
Sorter, Top View Closed



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H127_2087DA

Sorter, Top View Open

**Sorter and Processor, Full View**



Sorter, Cross Section View

Module 6

Troubleshooting and Diagnostics



Fill-in the Blanks

1. The Error Code is stored in the memory of the Processor's 500 Board. Use your laptop computer to retrieve the Error Code.
2. Troubleshooting information in table format for Error Codes can be found in this Section of the Service Manual: Diagnostics.
3. The machine is indicating an Error Code "E097". What does this mean?
Film did not arrive at Bin #7.
4. Error Code "E093" indicates that film did not arrive in Bin #3. An inspection finds no film jam and that the Diverters for Bins #1 and #2 operate normally. What two other possible malfunctions could cause this error? a) The Diverter for Bin #3 may not be operating or b) the film was not sensed in Bin #3.
5. With the Bin Assembly in position, you receive an Error Code "E080." A check of the 4000 Circuit Board shows that all three LED's are deenergized. What is the most likely malfunction? faulty Bin Interlock Switch.
6. The speed of the processor is out of range (Error Code E082) and the Processor transport is running. What test point would you check for a pulse signal that indicates the U11 Sensor needs to be replaced? P/J123 Pin 31.
7. A quick procedure that can be used to check the operational status of a Bin Sensor is to: Using the Portable Computer and "Sorter Sensor Test" mode, check the Sensor status by activating the Sensor with a piece of film.
8. Your Software Diagnostics indicates a Solenoid is not functioning. A quick procedure to check if it is the Solenoid that is faulty is to: switch the suspected Solenoid with a known good Solenoid.

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